GCSE Physics Investigation on Circular Motion.
Ashav Norda
11BP

Title: Investigating Circular Motion

Aim:

The aim of this experiment is to investigate the patterns of circular motion using a rubber bung tied to the end of some fishing wire.

Background Information:

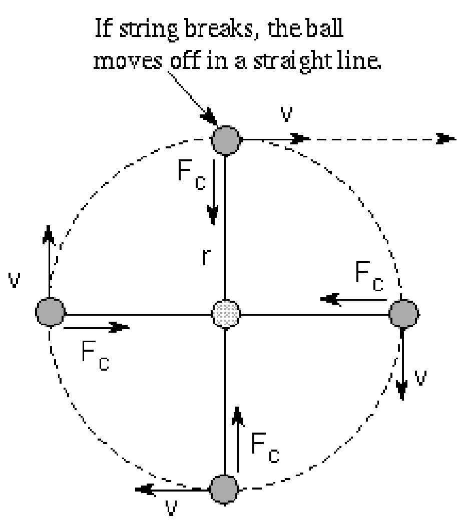
Newton's first law of motion says that an object's inertia will keep it from changing its speed and/or direction unless some force acts on it. This means that satellites orbiting the Earth must be feeling some force that constantly deflects them toward the centre of the Earth. If there was no force, they would travel in a straight line at a constant speed.

If you whirl a ball attached to string around your head, it moves in a circular path around you because the string is always pulling the ball directly toward the hand grabbing the string. The ball wants to move in a straight line and the string is pulling it directly inward. The resulting deflection is a compromise: a circular path. The string is applying a centripetal force to the ball: an inward force. If you let go of the string, there is no centripetal force and the ball will fly off in a straight line because of its inertia. If you do not whirl the ball fast enough it will move inward to a smaller non-circular path around you. If you whirl the ball too fast, you may not be able to give it enough centripetal force to keep it in a circular path around you. The amount of centripetal force needed to balance an object's inertia and keep it in a circular path of radius r is found from Newton's second law: the centripetal force,

$$= mv^2 / r$$

Where v and m are the object's speed and mass, respectively. The radius of the orbit r is the same as the distance between the moving object and the central body.

Here is a diagram that I drew explaining how the centripetal force of a object like a ball works.



$F_c = m v^2 / r$

Just enough centripetal force F_c to balance the speed; just enough speed

There are three possible factors or variables that can affect the force. There is the weight put on the nylon wire also known as the tension applied. There is the diameter of the nylon wire and there is the weight of the bung.

To decide which variable I was going to test I did some preliminary work. This would help me see what variable was the ideal one to use and what ranges I was going to use for the investigation.

Preliminary Work:

Method:

- A rubber bung was taken; a hole was then drilled into it.
- A nylon line fed through the middle part of the hole. The centre of gravity of the bung was then obtained by finding the centre of the bung's length and its breadth.
- The nylon line is to be fed through the plastic tube. The length between the tip of the plastic tube and the centre of gravity of the bung was set to the lengths specified in the range selection, and a knot tied at that point.
- Also a crocodile clip was placed to ensure that the wire stayed in one place. Once done, place weights on the wire, because I was going to investigate the radius I had kept the weight constant a 200g.
- Now swing the bung and time how long it takes to complete 20 revolutions. Record results on a results table. Repeat for precision. This is because if you have a multiple set of results, you can also cross-refer with them, and can interpret which set of results are more reliable.

We had to use certain apparatus for this experiment; it is all listed below in the apparatus list.

Safety:

1. Wear safety goggles, otherwise the bung can take ones eye out.

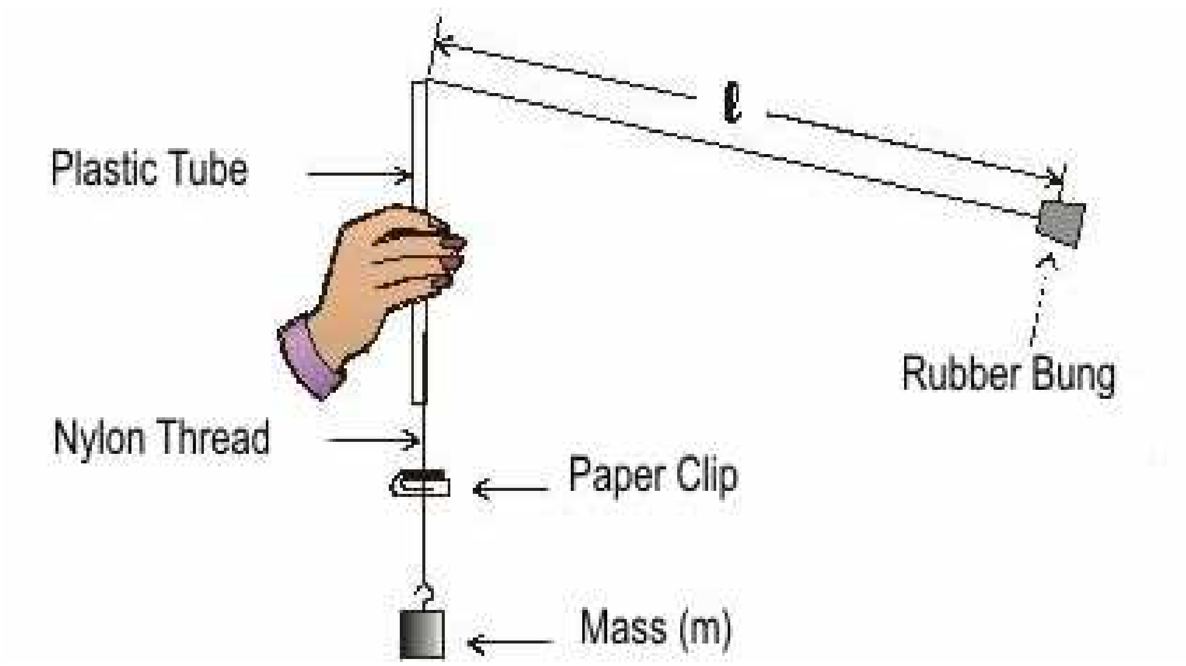
To Ensure a Fair Test:

1. Make sure that the diameter of the fishing wire is constantly 63mm.
2. Place the right weights on the fishing wire, to add up correctly.
3. Make accurate calculations to at least 2 decimal places.

Apparatus List

1. Ruler
2. Bung
3. 50 gram weights
4. Fishing Wire
5. Plastic Tube
6. Timer
7. Crocodile Clips.

Diagram:



Results from Preliminary Work

From the experiment I can say that I am going to investigate measuring different size radii. Here are my results.

Radius/cm	Time taken to complete 20 revolutions / secs
100	11
125	8
150	7
175	6
200	6

225	5

I repeated the experiment to get accurate results.

Radius/cm	Time taken to complete 20 revolutions / secs
100	13
125	8
150	7
175	7
200	6
225	5

I have learnt that the range I have used Is good and I will use that for the plan. The preliminary experiment proved to be successful. This is clearly supported by the fact that the results obtained were very similar to one another, indicating the fact that they are also reliable.

Ranges:

Radius/cm
100
125
150
175
200
225

The other two factors:

Keep the weight at 200g and the mass of the bung the same.

Final Method:

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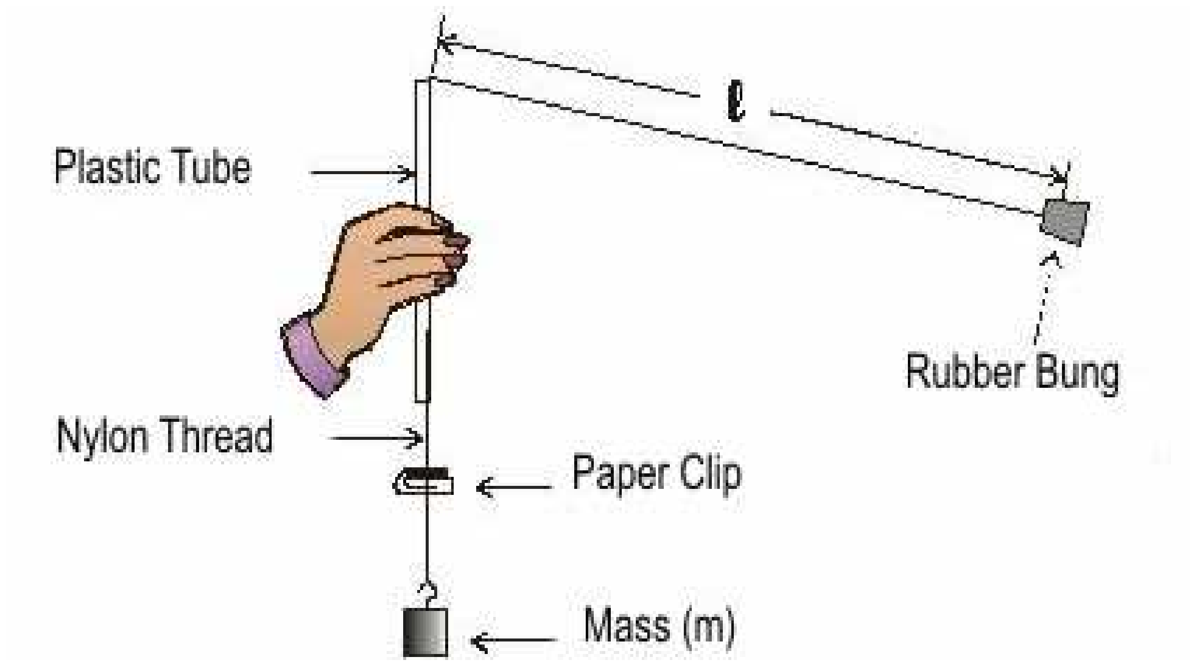

Prediction: I have learnt that as the radius of the thread increases the speed or time that is taken for the bung to move in 20 revolutions is faster than that with a smaller radius.